



United States Government Accountability Office  
Washington, DC 20548

March 3, 2011

Congressional Committees

Subject: *Depot Maintenance: Navy Has Revised Its Estimated Workforce Cost for Basing an Aircraft Carrier at Mayport, Florida*

This report responds to House Report 111-491 to accompany a bill for the National Defense Authorization Act for Fiscal Year 2011 (H.R. 5136). The House Report noted that according to the environmental impact statement for the proposed homeporting of additional ships at Naval Station, Mayport, Florida, homeporting of a nuclear-powered aircraft carrier would result in temporary surges of maintenance employees associated with the 3-year depot-level maintenance cycle for the aircraft carrier.<sup>1</sup> The homeporting of the aircraft carrier at Mayport is projected to begin in fiscal year 2019. Also, the House report raised questions about the potential impact that the additional depot-level workload would have on the sustainability, efficiency, capabilities, and stability of the maintenance employees who would travel from Navy depots to Mayport to perform the maintenance.

To examine these issues, the House report directed GAO to provide an assessment of the readiness and cost impacts of the aircraft carrier homeporting and maintenance at Mayport on the Navy's traveling workforce. In response, our objectives were to determine the extent to which (1) the Navy has identified potential workforce-related costs associated with the planned move and used cost-estimating best practices to do so and (2) the readiness of the traveling workforce may be affected by having an aircraft carrier homeported in Mayport, and any mitigation measures the Navy has planned and implemented to address any potential impact. The related GAO products section at the end of the report identifies our other recent efforts examining issues related to the proposed homeporting of an aircraft carrier at Mayport.

To conduct this work, we reviewed the Navy's workforce-related cost estimates and maintenance plans for the aircraft carrier move. We compared the Navy's estimates and supporting documentation against both criteria identified in cost-estimating best practices and our independent cost estimate. A high quality cost estimate meets the following four characteristics: (1) *comprehensive* – estimates should include all possible costs structured in sufficient detail to help ensure that costs are neither omitted nor doubled-counted; (2) *well-documented* – estimates should be supported by detailed documentation that describes the process, sources, and methods used to create the estimates; (3) *accurate* - estimates should be based on the assessment of the costs most

---

<sup>1</sup> While the Navy's final environmental impact statement notes a 3-year depot-level maintenance cycle for the aircraft carrier, the Navy stated in its oral comments that the maintenance cycle is 32 months..

Report Documentation Page				Form Approved OMB No. 0704-0188	
Public reporting burden for the collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to a penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.					
1. REPORT DATE <b>03 MAR 2011</b>		2. REPORT TYPE		3. DATES COVERED <b>00-00-2011 to 00-00-2011</b>	
4. TITLE AND SUBTITLE <b>Depot Maintenance: Navy Has Revised Its Estimated Workforce Cost for Basing an Aircraft Carrier at Mayport, Florida</b>				5a. CONTRACT NUMBER	
				5b. GRANT NUMBER	
				5c. PROGRAM ELEMENT NUMBER	
6. AUTHOR(S)				5d. PROJECT NUMBER	
				5e. TASK NUMBER	
				5f. WORK UNIT NUMBER	
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) <b>U.S. Government Accountability Office, 441 G Street NW, Washington, DC, 20548</b>				8. PERFORMING ORGANIZATION REPORT NUMBER	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)				10. SPONSOR/MONITOR'S ACRONYM(S)	
				11. SPONSOR/MONITOR'S REPORT NUMBER(S)	
12. DISTRIBUTION/AVAILABILITY STATEMENT <b>Approved for public release; distribution unlimited</b>					
13. SUPPLEMENTARY NOTES					
14. ABSTRACT					
15. SUBJECT TERMS					
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT <b>Same as Report (SAR)</b>	18. NUMBER OF PAGES <b>31</b>	19a. NAME OF RESPONSIBLE PERSON
a. REPORT <b>unclassified</b>	b. ABSTRACT <b>unclassified</b>	c. THIS PAGE <b>unclassified</b>			

likely to be incurred and should not be overly conservative or too optimistic; and (4) *credible* – estimates should be cross-checked with an independent cost estimate, the level of confidence should be identified through a risk and uncertainty analysis, and a sensitivity analysis has been conducted.<sup>2</sup> We also analyzed Department of Defense (DOD) and Navy guidance and planning documents to identify requirements for the traveling workforce, as well as workforce-performance and capabilities information obtained for similar travel from depots to maintain aircraft carriers homeported in San Diego, California. For both objectives, we interviewed DOD and Navy officials about the proposed move to solicit their views and supplement information obtained from documents.

We conducted this performance audit from June 2010 through March 2011 in accordance with generally accepted government auditing standards. Those standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.

## Summary

In 2010, the Navy revised its original (2008) estimate of annualized workforce-related costs from about \$18 million to \$8.2 million. The Navy revised its estimate as a result of discussing its estimate with us and identifying more correct and complete assumptions than had been used to develop the original estimate. For example, the original estimate used the more expensive travel rates for San Diego instead of Mayport. To assess the validity of the revised estimate, we also developed an independent cost estimate. Our independent, risk-adjusted, annualized estimate for the workforce-related recurring costs is about \$10.6 million at the 65 percent confidence interval, which means that there is a 65 percent probability the actual cost will be \$10.6 million or less. We also estimated that these risk-adjusted costs could range from \$5.5 million to \$14.1 million.<sup>3</sup> The difference is attributable in part to our estimate being based on a risk analysis while the Navy's was not. Our assessment of the Navy's cost-estimating procedures found that the Navy's procedures met best practices to various degrees. For example, the Navy's procedures met the requirements to comprehensively include both types of workforce-related costs (traveling and permanently stationed employees' costs) involved in the move. However, the Navy's procedures minimally met the credible criteria because they did not, among other things, include risk and sensitivity analyses or an independent cost estimate.

The Navy has not begun to identify or document potential effects on readiness that might occur as a result of the proposed move nor has it identified workforce-related mitigation strategies because the move is years away. However, Navy officials indicated that the *U.S. Navy Depot Maintenance Strategic Plan* outlines strategies that will be used to address potential risks to readiness. Also, they indicated that they will begin to

---

<sup>2</sup> GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: March 2009).

<sup>3</sup> The range is based on the 80 percent confidence level, which means that there is an 80 percent probability that the actual cost will fall within the stated range.

implement these strategies 4 to 5 years before moving the aircraft carrier to Mayport. We found that the Navy has processes to manage the workforce that include depot workers traveling to other locations to perform aircraft carrier maintenance. While the move to Mayport will result in increased travel for the workforce, Navy officials told us that they currently meet workforce travel requirements while staffed almost entirely by workers who voluntarily elect to travel. Navy officials do not anticipate any challenges in identifying a sufficient number of workers with the appropriate skills to perform maintenance work at Mayport. Further, Navy officials have indicated that the performance of the traveling workforce conducting remote aircraft carrier depot maintenance slightly exceeds that of workers requiring no travel.

We are not making any recommendations in this report because we are issuing another report in March 2011 that addresses and makes recommendations to improve the Navy's overall costs of moving an aircraft carrier to Mayport.<sup>4</sup> The enclosure contains briefing slides that provide additional details regarding our findings and the scope and methodology used to prepare this report.

### **Agency Comments and Our Evaluation**

We provided a draft of this product to DOD for review and agency comments. DOD did not submit written agency comments, but the Navy provided technical and oral comments. We incorporated the technical comment that clarified the length of the maintenance cycle as 32 months into our report.

In oral comments, the Navy's Director, Fleet Readiness Division, stated that the Navy's workforce cost estimate was based on approved models used in the Planning, Programming, Budgeting, and Execution process and that these models are validated every 3 years by an outside organization. The Director also stated that the Navy will not seek an independent estimate for each of the thousands of estimates it produces because it would be time and cost prohibitive.

Our report acknowledges that the Navy's cost estimates were based on validated models. However, we also identified problems in the application of those models. Among other things, we noted that the Navy's estimate minimally met the criteria for a credible estimate because: (1) cost drivers were not checked to determine whether alternative methods produced similar results, (2) the estimate did not include a sensitivity risk analysis, and (3) the estimate did not provide evidence to indicate that the Navy's estimate was compared to an independent estimate from an outside organization. We recognize that resource constraints limit the Navy's ability to obtain independent estimates for all of its cost estimates, but we continue to believe that cost issues raised about homeporting an aircraft carrier at Mayport warrant the production of an independent cost estimate—an industry and a government cost-estimating best practice that we noted should be included in credible estimates—to facilitate informed decisions.

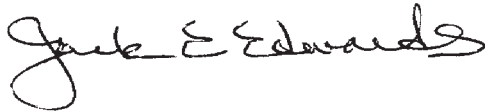
---

<sup>4</sup> GAO, *Defense Infrastructure: Navy Can Improve the Quality of Its Cost Estimate to Homeport an Aircraft Carrier at Naval Station Mayport, Florida*, GAO-11-309 (Washington, D.C.: Mar. 3, 2011).

---

We are sending copies of this report to the appropriate congressional committees. We are also sending copies to the Secretary of Defense; the Deputy Secretary of Defense; the Under Secretary Of Defense (Acquisition, Technology and Logistics); and the Secretary of the Navy. This report also is available at no charge on the GAO Web site at <http://www.gao.gov>.

Should you or your staff have questions concerning this report, please contact me at (202) 512-8246 or [edwardsj@gao.gov](mailto:edwardsj@gao.gov). Contact points for our Offices of Congressional Relations and Public Affairs may be found on the last page of this report. Key contributors to this report were Carleen Bennett, Assistant Director; Allen Westheimer; Jennifer Echard; Dave Hubbell; Carol Petersen; Cheryl Weissman; and Michael Willems.

A handwritten signature in black ink that reads "Jack E. Edwards". The signature is fluid and cursive, with the first letters of the first and last names being capitalized and prominent.

Jack E. Edwards  
Director, Defense Capabilities and Management

Enclosure

## **List of Committees**

The Honorable Carl Levin  
Chairman  
The Honorable John McCain  
Ranking Member  
Committee on Armed Services  
United States Senate

The Honorable Daniel K. Inouye  
Chairman  
The Honorable Thad Cochran  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
United States Senate

The Honorable Howard P. McKeon  
Chairman  
The Honorable Adam Smith  
Ranking Member  
Committee on Armed Services  
House of Representatives

The Honorable C. W. Bill Young  
Chairman  
The Honorable Norman D. Dicks  
Ranking Member  
Subcommittee on Defense  
Committee on Appropriations  
House of Representatives



---

# **Depot Maintenance: Navy Has Revised Its Estimated Workforce Costs on Basing an Aircraft Carrier at Mayport, Florida**

---

**Briefing for Congressional Committees  
March 03, 2011**

---

---



---

## Contents

---

- Introduction
  - Congressional Direction
  - Objectives
  - Scope and Methodology
  - Summary of Findings
  - Objective 1: Potential Cost-Related Effects
  - Objective 2: Potential Effect on Readiness
  - Agency Comments and Our Evaluation
  - Related GAO Products
-





## Introduction

### Decisions and Actions Taken Regarding the Planned Relocation of an Aircraft Carrier

- The 2001 *Quadrennial Defense Review* recommended that the Navy provide more warfighting assets more quickly to multiple locations.
- The Navy subsequently took actions to homeport additional surface ships at Naval Station, Mayport, Florida. For example:
  - 2008: The Navy prepared an environmental impact statement to evaluate a range of options for homeporting Navy ships at Mayport.<sup>1</sup>
  - 2009: The Navy announced its plan to homeport an aircraft carrier at Mayport.
- In the 2010 *Quadrennial Defense Review*, the Department of Defense (DOD) confirmed the Navy's decision to base an aircraft carrier at Mayport. The Navy plans to begin homeporting an aircraft carrier at Mayport in 2019.

<sup>1</sup> Department of the Navy, *Final Environmental Impact Statement for the Proposed Homeporting of Additional Surface Ships at Naval Station Mayport, Florida*, November 2008.



---

## **Introduction**

### **Aircraft Carrier Homeporting**

---

- The homeports for the Navy's 11 aircraft carriers are as follows:
    - Seven at Naval shipyards or Naval bases located near shipyards:
      - Norfolk Naval Station, Norfolk, Virginia—5 aircraft carriers
      - Naval Base Kitsap Bremerton, Washington—1 aircraft carrier
      - Everett Naval Station, Everett, Washington—1 aircraft carrier
    - Four at locations not near Naval shipyards:
      - North Island Naval Air Station, San Diego, California—3 aircraft carriers
      - Yokosuka Naval Base, Japan—1 aircraft carrier
  - Mayport served as a homeport to a conventionally powered aircraft carrier until 2007.
  - All current Navy aircraft carriers are nuclear powered. The nuclear power plant is used to create the steam and electricity that power the ship's propulsion and other operating systems, such as the catapults for launching aircraft and the generation of fresh water. Maintenance of the aircraft carrier therefore involves both
    - the nuclear power plant and
    - the nonnuclear systems.
-



---

## **Introduction**

### **Levels of Ship Maintenance**

---

- The Navy identifies three levels of ship maintenance:
    - Organizational – The ship’s crew performs as-needed, routine tasks, such as replacing minor parts, lubricating machinery, and preventive inspections.
    - Intermediate – Navy and civilian personnel from designated facilities use specialized skills to conduct more extensive work on a schedule of periodic cycles.
    - Depot – Civilians at Naval and private shipyards perform maintenance that requires skills, facilities, or capacities normally beyond those of the organizational and intermediate levels, including ship overhauls, alterations, refits, restorations, and nuclear refueling.
  - Maintenance for an aircraft carrier differs from that for other surface ships in that aircraft carriers are the only surface ships with nuclear propulsion systems, and all maintenance on nuclear propulsion systems is performed by Naval shipyard workers.
  - Norfolk and Puget Sound Naval Shipyards are primarily responsible for maintaining the Navy’s aircraft carriers. Workers from the Navy’s other two shipyards—Pearl Harbor Naval Shipyard, Honolulu, Hawaii, and Portsmouth Naval Shipyard, Portsmouth, New Hampshire—also perform minimal carrier work.
-



---

## Introduction

### Naval Shipyard Maintenance Workforce

- 
- The current workforce for the four Naval shipyards totals about 26,500.
  - Naval Sea Systems Command
    - establishes and shapes the overall size of the Naval shipyard workforce based on expected workload and
    - manages the maintenance of Navy ships and submarines.
  - Naval Sea Systems Command's "One Shipyard" concept is intended to mitigate imbalances resulting from a Naval shipyard's having a workload that exceeds or falls short of its available workforce. A resolution may require borrowing workers from other Naval shipyards or loaning workers out.
    - Maintenance performed by shipyard workers at a Naval shipyard is "on shipyard."
    - Maintenance performed by shipyard workers at a homeport or other locations that are not at a Naval shipyard is "off shipyard."



---

## **Introduction**

### **Naval Shipyard Maintenance Workforce**

- 
- The number of Naval shipyard workers performing off shipyard maintenance on aircraft carriers varies, depending on the phase of an aircraft carrier's maintenance cycle.
    - To facilitate planning for carrier maintenance, the Navy has developed a general maintenance model that spans the expected 50 years of a carrier's lifespan in the active inventory.
    - Scheduled aircraft carrier maintenance periods are known as availabilities.
      - Aircraft carrier maintenance, scheduled for periods of 6 months or less, is ordinarily performed in the ship's homeport area.
      - Most of a carrier's maintenance is performed at the homeport.



---

## Congressional Direction

---

- The House Armed Services Committee, in House Report 111-491 to accompany a bill for the National Defense Authorization Act for Fiscal Year 2011 (H.R. 5163),
  - noted that the environmental impact statement for the proposed homeporting of an aircraft carrier and additional ships at Mayport would result in temporary surges of workers traveling to Mayport;
  - raised questions about the potential impact that additional depot-level workload would have on the sustainability, efficiency, capabilities, and stability of the traveling workforce under the Navy's "One-Shipyards" concept; and
  - directed GAO to provide an assessment by February 15, 2011, of the readiness and cost impacts of aircraft carrier homeporting and maintenance at Mayport on the Navy's traveling workforce.<sup>2</sup>
- This report is one of three GAO products that respond to the House Report 111-491. A second report assesses the full life cycle costs to be incurred by the federal government by the proposed homeporting,<sup>3</sup> and a third future report will assess the infrastructure needed to support the aircraft carrier move to Mayport.

---

<sup>2</sup>We provided the draft report to DOD and the House Armed Services Committee on January 21, 2011 and agreement was made that we will issue this report at a later date.  
<sup>3</sup>GAO, *Defense Infrastructure: Navy Can Improve the Quality of Its Cost Estimate to Homeport an Aircraft Carrier at Naval Station Mayport, Florida*, GAO-11-309 (Washington, D.C.: Mar. 3, 2011).



---

## Objectives

- 
- Our objectives were to determine the extent to which
    1. the Navy has identified potential workforce-related costs associated with the planned move and used cost-estimating best practices to do so and
    2. the readiness of the traveling workforce may be affected by having an aircraft carrier homeported in Mayport, and any mitigation measures the Navy has planned and implemented to address any potential impact.



## Scope and Methodology

### Objective 1 – Potential Cost-Related Effects

- For objective 1, we took the following steps:
  - Reviewed the original (2008) and revised (2010) cost estimates for aircraft carrier homeporting at Mayport.
  - Interviewed DOD and Navy officials to identify the segment of the overall costs that are workforce related. We also interviewed these officials to obtain an understanding of any issues that could affect these costs in the future.
  - Assessed the Navy's original and revised cost estimate by using criteria for developing high-quality cost estimates as outlined in the *GAO Cost Estimating and Assessment Guide*.<sup>4</sup>
  - Developed an independent cost estimate by following best practices as stated in the GAO Cost Estimating Guide. Specifically, we developed a risk-adjusted range of estimates (at an 80 percent confidence interval) of workforce-related recurring costs. We also compared the Navy's point estimate (which represents the most likely value for the cost estimate) with our estimates to determine whether the Navy's estimate was within our risk-adjusted range. For a direct element-by-element comparison between our estimate and the Navy's, we compared the Navy's point estimate to our estimate at the 65 percent confidence level, which the guide considers appropriate for decision making.
  - Reviewed our preliminary findings with Navy officials to solicit their views on any differences between our findings and those of the Navy.

<sup>4</sup> GAO, *GAO Cost Estimating and Assessment Guide: Best Practices for Developing and Managing Capital Program Costs*, GAO-09-3SP (Washington, D.C.: March 2009).





## Scope and Methodology

### Objective 2 – Potential Effect on Readiness

- For objective 2, we took the following steps:
  - Analyzed Navy policies and instructions to understand the traveling workforce requirements.
  - Compared workforce performance and capabilities data on aircraft carrier availabilities at San Diego with data on Puget Sound and Norfolk Naval Shipyards' availabilities to understand how the traveling workforce currently conducts aircraft carrier maintenance.
  - Reviewed GAO's guidance on strategic workforce planning elements and compared it with Navy's workforce plans to determine the extent to which the plans contain or lack strategic elements.
  - Interviewed Navy officials regarding any potential impact on readiness and their rationale and assumptions in developing their mitigation strategies.
- We conducted this performance audit from June 2010 through March 2011 in accordance with generally accepted government auditing standards. For both objectives, we interviewed officials at the Office of the Chief of Naval Operations and Naval Sea Systems Command. The government auditing standards require that we plan and perform the audit to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our audit objectives. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our audit objectives.



## Summary of Findings

- **Objective 1:** In 2010, the Navy revised its original (2008) estimate of annualized workforce-related costs from about \$18 million to \$8.2 million. The Navy revised its estimate as a result of discussing its estimate with us and identifying more correct and complete assumptions than had been used to develop the original estimate. For example, the original estimate used the more expensive travel rates for San Diego instead of Mayport. To assess the validity of the revised estimate, we also developed an independent cost estimate. Our independent, risk-adjusted, annualized estimate for the workforce-related recurring costs is about \$10.6 million at the 65 percent confidence interval, which means that there is a 65 percent probability the actual cost will be \$10.6 million or less. We also estimated that these risk-adjusted costs could range from \$5.5 million to \$14.1million.<sup>5</sup> The difference is attributable in part to our estimate being based on a risk analysis while the Navy's was not. Our assessment of the Navy's cost-estimating procedures found that the Navy's procedures met best practices to various degrees. For example, the Navy's procedures met the requirements to comprehensively include both types of workforce-related costs (traveling and permanently stationed employee costs) involved in the move. However, the Navy's procedures minimally met the credible criteria because they did not, among other things, include risk and sensitivity analyses or an independent cost estimate.

<sup>5</sup> The range is based on the 80 percent confidence interval, which means that there is an 80 percent probability that the actual cost will fall within the stated range. 12



## Summary of Findings (cont'd)

- **Objective 2:** The Navy has not begun to identify or document potential effects on readiness that might occur as a result of the proposed move nor has it identified workforce-related mitigation strategies because the move is years away. However, Navy officials indicated that the *U.S. Navy Depot Maintenance Strategic Plan* outlines strategies that will be used to address potential risks to readiness. Also, they indicated that they will begin to implement these strategies 4 to 5 years before moving the aircraft carrier to Mayport. We found that the Navy has processes to manage the workforce that include depot workers traveling to other locations to perform aircraft carrier maintenance. While the move to Mayport will result in increased travel for the workforce, Navy officials told us that they currently meet workforce travel requirements while staffed almost entirely by workers who voluntarily elect to travel. Navy officials do not anticipate any challenges in identifying a sufficient number of workers with the appropriate skills to perform maintenance work at Mayport. Further, Navy officials have indicated that the performance of the traveling workforce conducting remote aircraft carrier depot maintenance slightly exceeds that of workers requiring no travel.
- We are not making any recommendations in this report because we are issuing another report in March 2011 that addresses and makes recommendations to improve the Navy's overall costs of moving an aircraft carrier to Mayport.



## Objective 1: Potential Cost-Related Effects

### Correcting Assumptions in the Navy's Original Cost Estimates Resulted in Smaller Revised Estimated Workforce Costs

- The Navy's revised annualized cost estimate is lower—\$8.2 million versus \$17.9 million—than its original estimate for workforce-related costs associated with moving an aircraft carrier to Mayport.
- As a result of our discussions with Navy officials, the Navy revised its original estimate and the three assumptions that did not correctly or fully represent future planned conditions.
  - The Navy originally used the more expensive per diem for San Diego, California, rather than the one of Mayport, Florida.
  - The original estimate included an overstated amount of workload to be performed at Mayport and therefore overstated the amount of travel costs. Specifically, an assumption used in the original estimate did not take into account a projected 39-month drydocking that must be performed at Norfolk.
  - The Navy originally estimated that 50 workers rather than 12 workers would be permanently stationed at Mayport. In its revised estimate, the Navy did not include travel and per diem costs for 38 workers it had incorrectly assumed would be permanently based at Mayport.
- The lack of documentation for the original estimate made it difficult for us to identify assumptions and errors. Navy officials stated that the constrained deadlines caused them to not generate supporting documentation for the cost estimates.

**Table 1. Recurring, Annualized Workforce-related Costs of Moving a Carrier to Mayport (dollars in millions)**

Dollars in millions			
Source	Costs		
	Travel	Permanently stationed employees	Total
Original November 2008 estimate	\$12.9	\$5.0	<b>\$17.9</b>
Revised August 2010 estimate	7.0	1.2	<b>\$8.2</b>
<b>Decrease in estimated costs</b>	<b>\$5.9</b>	<b>\$3.8</b>	<b>\$9.7</b>

Source: GAO analysis of DOD data.



## Objective 1: Potential Cost-Related Effects

### The Navy's Revised Estimate Does Not Account for Cost Risks

- Our independent, risk-adjusted, annualized estimate for the workforce-related recurring costs is about \$10.6 million at the 65 percent confidence interval, which means that there is a 65 percent probability the actual cost will be \$10.6 million or less.<sup>6</sup>
- We also estimated that these risk-adjusted costs could range from \$5.5 million to \$14.1 million at the 80 percent confidence interval, which means that there is a 80 percent probability that the actual cost will be within that range. The Navy's non-risk adjusted estimate of \$8.2 million falls within our range.
- The differences between the estimating methods are as follows:
  - Our estimate is based on actual expenses incurred for the *USS Ronald Reagan* planned incremental availability in 2009 in San Diego because this availability is the one most similar to the ones expected to occur at Mayport. In addition, we used a risk analysis, which evaluates each cost estimate variable for uncertainty, to estimate a range of costs.
  - The Navy based its estimate on estimated expenses, for example, the total number of shipyard workers and the number of person-days for the traveling workforce. The Navy developed its estimate with a general cost-estimating model that had been validated by an independent entity at a university, but the Navy had not had its original or revised cost estimate independently validated before we developed our estimate. Moreover, the Navy's estimate did not include a risk analysis.
- Both methods factored in the total number of maintenance person-days over an aircraft carrier's life cycle and calculated a life cycle and an annualized estimate.

<sup>6</sup> In accordance with the principles outlined in the *GAO Cost Estimating and Assessment Guide*, the 65 percent confidence interval is appropriate for decision making.



## Objective 1: Potential Cost-Related Effects

### Characteristics of a High-Quality Cost Estimate That Can Be Used for Making Informed Decisions

- Using industry and government cost-estimating best practices, we identified the characteristics of a high-quality cost estimate that management can use for making informed decisions:<sup>7</sup> A cost estimate is
  - **comprehensive** when it accounts for all possible costs associated with a project and is structured in sufficient detail to ensure that costs are neither omitted nor double-counted, and the estimating teams' composition is commensurate with the assignment;
  - **well-documented** when supporting documentation is accompanied by a narrative explaining the process, sources, and methods used to create the estimate and contains the underlying data used to develop the estimate;
  - **accurate** when it is based on an assessment of the costs most likely to be incurred and is not overly conservative or too optimistic; and
  - **credible** when it has been cross-checked with an independent cost estimate, the level of confidence associated with the point estimate has been identified through a risk and uncertainty analysis, and a sensitivity analysis has been conducted—that is, the project has examined the effect of changing one assumption related to each project activity while holding all other variables constant in order to identify which variable most affects the cost estimate.

<sup>7</sup> GAO-09-3SP.



## Objective 1: Potential Cost-Related Effects

### The Navy's Procedures Used for the Revised Estimate Met Cost-estimating Best Practices to Various Degrees

- In its original (2008) estimate of annualized, recurring workforce costs, the Navy did not fully follow cost-estimating best practices. Among other things, that estimate lacked supporting documentation.
- For the revised estimate, we determined that the Navy followed the best practices to various degrees:<sup>8</sup>
  - **Comprehensive:** Met – The Navy's procedures met the requirements to comprehensively include both types of workforce-related costs (traveling and permanently stationed employees' costs) involved in the move.
  - **Well-documented:** Partially met – The Navy's documentation provided the formula to calculate travel costs but did not supply source data and assumptions for the workers projected to be permanently stationed at Mayport. The Navy documented travel and per diem costs in a spreadsheet. However, we could not independently trace the cost information back to source documentation.
  - **Accurate:** Partially met – For the revised estimate, the Navy accounted properly for inflation, changed the previously cited incorrect assumptions, and based costs on a validated cost model. The Navy's travel and permanent on-site labor costs were not based on an assessment of the most likely costs as the Navy did not perform a risk analysis.
  - **Credible:** Minimally met – The Navy identified cost drivers, but the cost drivers were not checked to determine whether alternative methods produce similar results. The Navy's estimate does not include sensitivity or risk and uncertainty analyses. Also, the Navy did not compare its estimate to an independent cost estimate conducted by a group outside the acquiring organization.

<sup>8</sup> Met: The Navy provided complete evidence that satisfies the entire criterion. Substantially met: The Navy provided evidence that satisfies a large portion of the criterion. Partially met: The Navy provided evidence that satisfies about half of the criterion. Minimally met: The Navy provided evidence that satisfies a small portion of the criterion. Not met: The Navy provided no evidence that satisfies any of the criterion. 17



---

## **Objective 1: Potential Cost-Related Effects**

### **The Navy Did Not Fully Follow Cost-Estimating Best Practices for the Overall Revised Estimated Costs Associated with the Move**

---

- In another March 2011 report that examined the overall revised estimated costs associated with the move, we found that the Navy did not fully follow cost-estimating best practices.<sup>9</sup>
  - In that report, we recommended that the Navy improve future revisions to its Mayport aircraft carrier homeporting cost estimate as part of the annual budgetary process or in response to future congressional requests.
- We are not making a separate recommendation in this report on following cost-estimating best practices because the recommendation in the other report encompasses workforce costs.

---

<sup>9</sup> GAO-11-309.





## Objective 2: Potential Effect on Readiness

### The Navy Has Not Identified Effects on Readiness or Mitigation Strategies Because the Move Is Years Away

- Because the move is still 8 years away, the Navy has not begun to identify and document potential workforce readiness effects associated with the move. However, Navy officials indicated that the *U.S. Navy Depot Maintenance Strategic Plan* outlines strategies that will be used to address potential risks to readiness. Also, they indicated that they will begin to implement these strategies 4 to 5 years before moving the aircraft carrier to Mayport.
- A Naval Sea Systems Command instruction states that the workforce management goal is to ensure the right person, with the right skills, is assigned to the right task at the right time.<sup>10</sup> To help meet this goal, the Navy:
  - uses a resource strategic planning strategy that provides for an adequately trained workforce of sufficient size, based on goals for hiring that reflect skill needs and attrition, that corrects for workload imbalances and
  - collects workforce status information such as the size of the available workforce, the amount of overtime, the percentage of workers in each of the trades that are experienced journeyman, and the numbers of workers loaned from one Naval shipyard to another to balance the workload across shipyards.
- DOD's *Risk Management Guide for DOD Acquisition*<sup>11</sup> and GAO's risk management framework<sup>12</sup> address the importance of evaluating alternatives to address risk and selecting and implementing the appropriate alternatives to mitigate potential risks.

<sup>10</sup> Naval Sea Systems Command Instruction 4850.11 (Jan. 15, 2010).

<sup>11</sup> DOD, *Risk Management Guide for DOD Acquisition*, Sixth Edition, August 2006.

<sup>12</sup> GAO, *Risk Management: Further Refinements Needed to Assess Risks and Prioritize Protective Measures at Ports and Other Critical Infrastructure*, GAO-06-91, (Washington, D.C.: Dec. 15, 2005).



## **Objective 2: Potential Effect on Readiness**

### **Navy Uses Routine Strategies to Manage the Workforce**

- Although the Navy does not report Naval shipyard workforce status in readiness terms—the sustainability, efficiency, capability, and stability of the workforce as cited in the House report—the Navy does collect data and monitor conditions that are related to these issues.
- We found that Navy shipyards collect data such as the shipyard workforce's total travel and the turnaround rate (the frequency with which its workers travel); however, they are not required to regularly collect and report this information.
- The Navy's shipyard workforce managers routinely consider balancing workloads among shipyards to avoid the risk of not meeting ship maintenance schedules.
- Navy documents and officials state that the Navy is taking steps to address current and future attrition.
  - Each shipyard will hire a minimum of 100 apprentices every year, as previously directed by the Senate Committee on Appropriations,<sup>13</sup> and it will hire entry-level workers.
  - The Puget Sound Naval Shipyard and Norfolk Naval Shipyard plan to hire over 200 apprentices every year, per shipyard.

<sup>13</sup> Senate Report 110-155 to accompany the bill that later became the Department of Defense Appropriations Act, 2008 (H.R. 3222) (Sept. 14, 2007); Senate Report 111-74 to accompany the bill that later became the Department of Defense Appropriations Act, 2010 (H.R. 3326) (Sept. 10, 2009).



---

## **Objective 2: Potential Effect on Readiness**

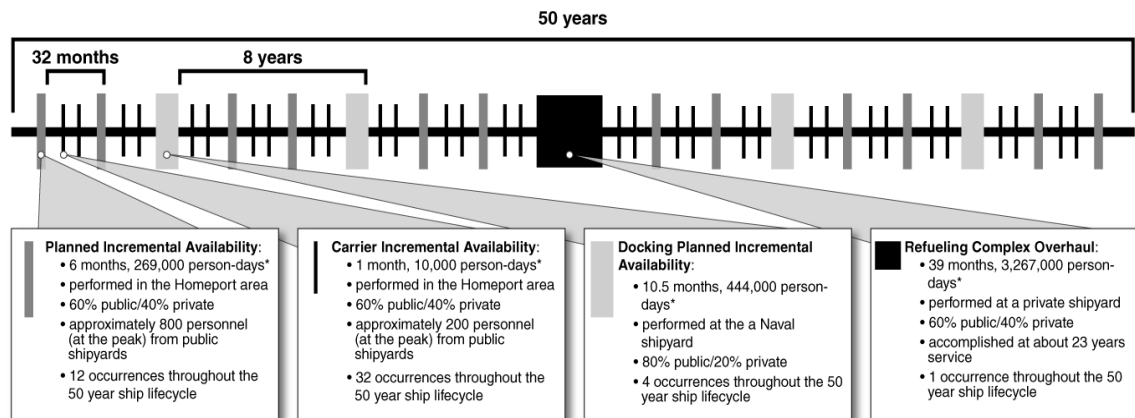
### **Shipyard Workforce Travels to Perform Aircraft Carrier Maintenance**

---

- Navy officials told us that the “One Shipyard” concept and workforce-shaping procedures ensure that the Navy will have the required number of workers and skill sets to meet current and planned maintenance requirements, such as those for Mayport.
  - On any given day, each shipyard has workers traveling to other locations to perform aircraft carrier maintenance. For example, during fiscal year 2010, the Puget Sound Naval Shipyard workforce averaged more than 600 workers per day on travel.
  - Navy officials stated that they typically get almost all volunteers to travel, and thus have to compel only a small number of workers to travel.
  - The traveling workforce has skills and experience similar to those of the overall workforce.
- As shown in figure 1, a recurring 8-year aircraft carrier maintenance cycle at Mayport would include two 6-month maintenance availabilities and other shorter maintenance efforts. Approximately 650 workers per day would be on temporary duty travel during each 6-month availability.

## Objective 2: Potential Effect on Readiness

Figure 1: 50-Year Aircraft Carrier Maintenance Cycle



Source: U.S. Navy.

\* Estimated number of person-days – Actual number of person-days required will be dependent on the aircraft carrier's maintenance needs.

Note: In addition to these availability maintenance periods, aircraft carriers have other periods of scheduled maintenance performed in the homeport area.



---

## **Objective 2: Potential Effect on Readiness**

### **Performance of Traveling Workforce is Slightly Better Than That of the Workforce at the Shipyards**

---

- According to Naval Sea Systems Command officials, the traveling workforce's performance rate for aircraft carrier availabilities—measuring the actual number of person-days needed to complete an availability against the number of person-days planned—is slightly better than that for the carrier availabilities performed at Naval shipyards, where no travel is required.
  - According to Navy officials, better performance is achieved by the traveling workforce because that workforce
    - is assigned for a specified period and works as part of the same team performing scheduled maintenance tasks on a single Navy ship;
    - is working away from the home shipyard, reducing the likelihood of workers (1) being reassigned to perform tasks on other ships or at other shipyards or (2) attending to personal and family-related responsibilities typically experienced while at home; and
    - is working more overtime, which in turn improves performance rates.
  - Savings achieved through the slightly better performance must be considered against the costs of overtime and travel (cited in our answer to objective 1) associated with conducting maintenance away from the shipyards.
-



---

## **Objective 2: Potential Effect on Readiness**

### **The Navy Has Not Identified Workforce-Related Mitigation Strategies for the Aircraft Carrier Move Because the Move Is Years Away**

---

- Naval Sea Systems Command officials told us that they have not identified workforce-related risk mitigation strategies because it would be speculative to discuss any mitigation strategies at this time. They also said:
  - The *U.S. Navy Depot Strategic Plan* outlines risk-mitigation steps that the service has used successfully in the past.
  - The Navy will begin to implement relevant strategies about 4 to 5 years before the planned move.
  - The specific aircraft carrier assigned to Mayport will not be identified until around 2 years prior to the move, and additional adjustments might need to be made to mitigate potential workforce-related effects.
  - The aircraft carrier's homeport location is not a factor in workforce planning. This planning is based on such factors as the number of aircraft carriers and their maintenance condition.



## Agency Comments and Our Evaluation

- In oral comments on a draft of this report, the Navy's Director, Fleet Readiness Division, stated that the Navy's workforce cost estimate was based on approved models used in the Planning, Programming, Budgeting, and Execution process and that these models are validated every 3 years by an outside organization. The Navy stated that it will not seek an independent estimate for each of the thousands of estimates it produces because it would be time and cost prohibitive.
- Our report acknowledges that the Navy's cost estimates were based on validated models. However, we also identified problems in the application of those models. Among other things, we noted that the Navy's estimate minimally met the criteria for a credible estimate because:
  - cost drivers were not checked to determine whether alternative methods produced similar results,
  - the estimate did not include a sensitivity risk analysis, and
  - the estimate did not provide evidence to indicate that the Navy's estimate was compared to an independent estimate from an outside organization.
- We recognize that resource constraints limit the Navy's ability to obtain independent estimates for all of its cost estimates, but we continue to believe that cost, workforce, and other concerns raised about homeporting an aircraft carrier at Mayport warrant the production of an independent cost estimate—an industry and a government cost-estimating best practice—to facilitate informed decisions.

25



---

## Related GAO Products

- 
- *Defense Infrastructure: Navy Can Improve the Quality of Its Cost Estimate to Homeport an Aircraft Carrier at Naval Station Mayport.* GAO-11-309. Washington, D.C.: March 3, 2011.
  - *Depot Maintenance: Improved Strategic Planning Needed to Ensure That Navy Depots Can Meet Future Maintenance Requirements.* GAO-10-585. Washington, D.C.: June 11, 2010.
  - *Defense Infrastructure: Opportunities Exist to Improve the Navy's Basing Decision Process and DOD Oversight.* GAO-10-482. Washington, D.C.: May 11, 2010.
  - *Human Capital: Key Principles for Effective Strategic Workforce Planning.* GAO-04-39. Washington, D.C.: December 11, 2003.
  - *DOD Civilian Personnel: Improved Strategic Planning Needed to Help Ensure Viability of DOD's Civilian Industrial Workforce.* GAO-03-472. Washington, D.C.: April 30, 2003.